

Online Review Systems: How emotional language drives sales

Completed Research Paper

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Abstract

How does emotional expression in online reviews affect sales? To answer this question, a model is constructed based on theories of sentiment. This model is tested experimentally. Controlling for online review valence online review emotionality affects product sales. The impact is moderated by product type, but not by product price. Specifically, online review language that expresses intense positive or negative emotions increases sales for hedonic products, but it doesn't affect sales for utilitarian products. This result has implications for the design of online review display algorithms.

Keywords

Online reviews, valence, arousal, emotional expression, sentiment, social media, sales, opinion mining, decision support

Introduction

People read online reviews as part of their decision-making process prior to purchase. According to industry research reports, a big proportion of consumers claim that their purchasing decision is largely influenced by online reviews (Deloitte 2007). In addition, consumers share these reviews with their family, friends or colleagues to make sense of their shopping experiences and deepen social connections (Peters and Kashima 2007). Companies such as Amazon and Alibaba have incorporated online reviews into their websites; this consumer created content arguably contributes to the customer experience; consumers are helping each other search the space of possible solutions to their needs (Duan et al. 2008; Hu 2006).

Understanding that consumers actively seek online reviews, companies design and implement different sorting algorithms that manipulate online reviews' visibility, hoping to improve consumers' search success and ultimately increase sales. Online reviews are sorted by a variety of review quality factors such as helpfulness, newness, sentiment, the number of likes, and source credibility (Amazon, YouTube and Yelp).

Researchers in different fields have studied online review text. For example, social scientists have examined how the valence (positive or negative) of online review text affects the perceived helpfulness of reviews (Sen and Lerman 2007). Computer scientists have designed automated sentiment analysis system that extract and summarizes the text of online reviews (Hu and Liu 2004). Researchers have also focused on other specific aspects of text, such as information load linguistic representations (e.g., readability) and product features described in these reviews (Park and Lee 2009). These prior studies analyzed how online review text changes people's shopping experiences. But how online review text affects sales is not clear from these studies.

This paper focuses on the emotional expression in online reviews. By doing so, we aim to provide a better understanding of how online reviews may affect consumer behavior. Specific to the interests of information systems researchers, this understanding may suggest new ways of designing more effective

online review display algorithms, that might, for example, seek to achieve objectives such as increased sales, improved shopping experiences, and better purchase decisions (Chen et al. 2004; Chau and Xu 2012; Dellarocas 2003; Duan et al. 2008; Ludwig et al. 2013; Muchnik et al. 2013; Mudambi and Schuff 2010; Qiang et al. 2011; Pavlou and Dimoka 2006).

The structure of this paper is as follows. The first part describes the literature related to online review systems and emotional expression in online reviews. The second part proposes a theoretical model and discusses two moderators: product type and product price. The third part introduces hypotheses. The fourth part presents the online experiment on Mechanical Turk that tests the hypotheses and the theoretical model. The final part of this paper discusses the findings, and suggests alternative designs for online review systems.

Online Review Systems

Online review systems are combinations of technologies and processes that are, effectively, decision support systems for consumers, and as a result they have been studied in the field of information systems (e.g., Dellarocas 2003). In online review systems, consumers read online reviews to make a purchasing decision. Once a product is purchased, delivered and used, the consumer may evaluate such product and post a review. These systems then use an online review display algorithm to present reviews. These reviews together with how they are presented will influence other consumers in their purchase decision-making (see Figure 1). This paper focuses on how the degree of emotion in a displayed review may influence purchase decisions, as part of a larger research program that seeks to understand and improve online review processes.

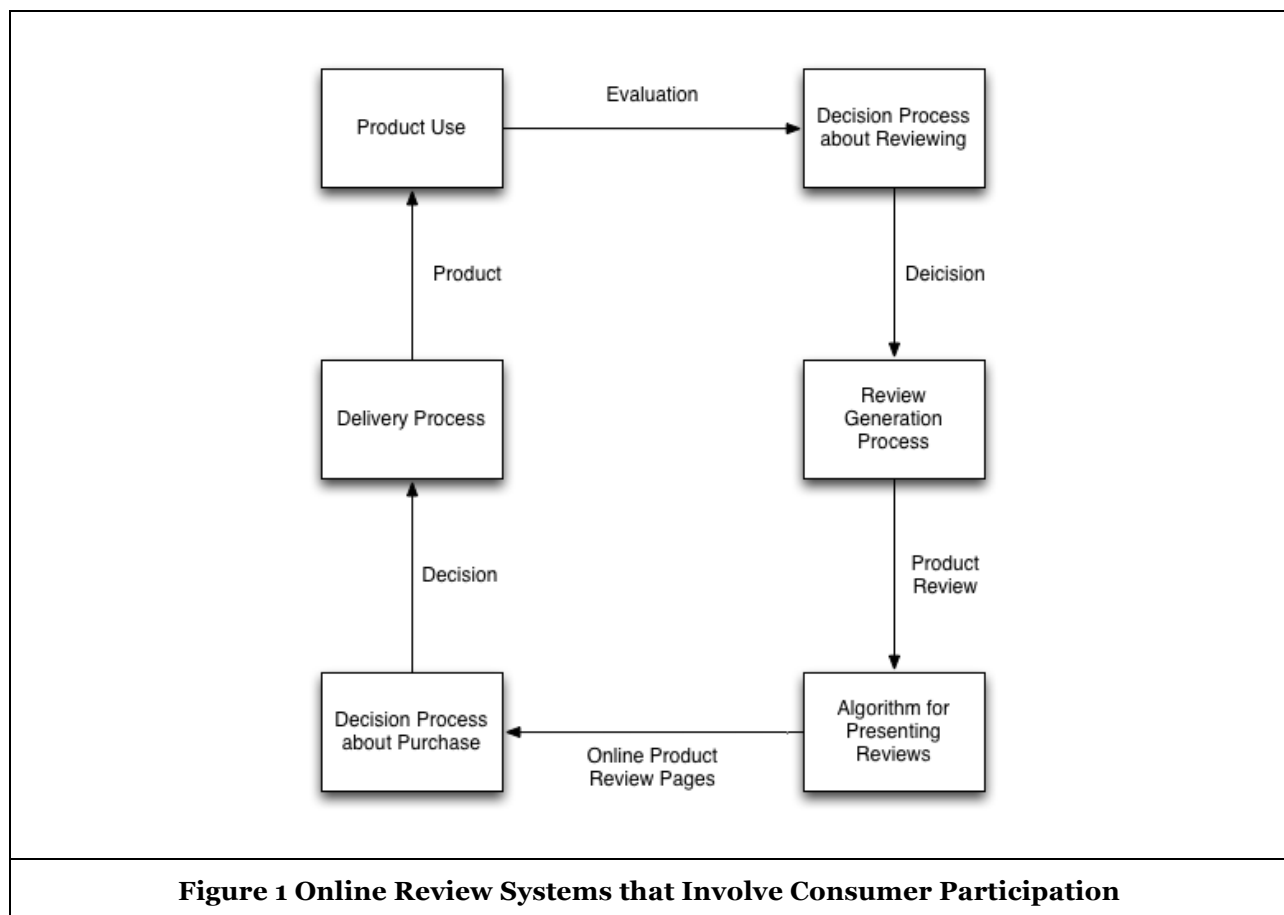


Figure 1 Online Review Systems that Involve Consumer Participation

Emotional Expression in Online Reviews

Sentiment is an important aspect of text processing. Sentiment is usually categorized as either positive or negative. Positive sentiment is associated with pleasure; negative sentiment with displeasure. But models of language have refined the concept of sentiment, offering two-dimensional models of text. A well-known two-dimensional model consists of a valence dimension (either positive or negative) and an arousal dimension (either high or low) (Russell, 1979; Warriner et al. 2013). While many studies have considered the valence of language in reviews, far fewer have considered the second dimension, the arousal dimension. For the purposes of clarity, we will refer to this arousal dimension as the emotionality of the text, and measure it as running along a spectrum from low emotion to high emotion according to the word dictionary included with Warriner et al. 2013.

A review can have similar valence but very different emotionality. For example two five star reviews might read: “I think the product is good” or “I really LOVE the product”. Both express positive valence. But the later sentence exhibits highly emotional language. In the same way, two one star reviews might read: “I think the product is flimsy” or “The product is terrible: I HATE it every minute”. Both exhibit negative sentiment, but the second uses more emotional language.

Why might emotion be important in reviews? First, a high emotion review with emotion-bearing words such as “love” and “hate” may arouse the consumer. Second, even if arousal is not triggered, a high emotion review may signal to the consumer that a product affected the reviewer strongly, and hence may cause the consumer to weight the review more heavily. We consider each idea in turn.

Arousal is a psychological state of being awake, leading to a condition of mobility and readiness to react (Smith and Ellsworth 1985). While low arousal is characterized by relaxation such as boredom and sadness, high arousal is characterized by activation such as excitement and anger (Heilman 1997). Prior research has shown that the excitatory state can encourage action-related behaviors including getting up to do exercise (Gaertner and Dovidio 1977). Purchasing a product also requires action. Then, emotional expression in the review may trigger arousal that leads to purchasing.

Alternatively, high emotion words also can be seen as representing the state of the person writing the review. So, for example, a review that uses very effusive language and recounts an emotional connection to a product may affect the decision maker who sees the review as evidence the product can produce strong reactions, either positive or negative. That is, the degree of emotion is used as a heuristic to judge the value of the product.

In sum, there are two plausible mechanisms through which highly emotional language could work: as a trigger for the state of the purchaser, or as an indicator of the strong effect the product has had on others. Moreover, cognitive science research suggests that the emotionality of language may affect memory in subtle ways (Gomes et al. 2013), and may even trigger different neural pathways (Kensinger and Corkin 2004). No matter the actual mechanism, these studies all suggest that the degree of emotionality in reviews may have an effect on cognitive processing, and hence on high-level decision-making related to purchasing products.

Specifically, high emotion positive online reviews may trigger more purchasing behaviors than low emotion positive online reviews. Consumers may be aroused by positive emotional expression in online reviews. Consumers may also attribute positive emotional expression to the reviewed products and weight these reviews heavily (Folkes 1988). If so, consumers will tend to purchase more after reading high emotion positive reviews.

On the other hand, assuming that negative information is more attention grabbing than positive information, high emotion negative online reviews can trigger arousal and induce curiosity (Baumeister et al. 2001; Vaish et al. 2008). Consumers, protected by anonymity and driven by curiosity, may not exhibit an aversion to products described in high emotion negative online reviews in some online scenarios (Mayzlin 2006). Alternatively, since negative emotions run against social norms, consumers may attribute the high emotion negative reviews to the reviewers’ personal dispositions (Kim and Gupta 2012) rather

than product failings. Together, these arguments suggest that high emotion negative online reviews may not decrease sales; on the contrary, they may boost the likelihood that the product is purchased.

Theoretical Model

In past work, we have shown that the valence of reviews does not have a uniform impact on sales (Ren and Nickerson 2013). In particular, we showed that aspects of the product moderated the effects of valence. Consistent with this past work, we conjecture that the effects of emotion in reviews on sales may vary for products that have different characteristics. We look at two product characteristics: product type and product price.

Product Type

Products can be classified as either hedonic or utilitarian (Figure 2). Hedonic products (such as music, movies and art) satisfy consumers' emotional wants: aesthetic and sensual pleasure, fantasy, and fun (Hirschman and Holbrook 1982). The evaluation for such products is subjective and emotional (Adaval 2001). High emotion reviews can arouse and activate consumers. At the same time, these reviews can also indicate that (1) reviewers have strong reactions to the hedonic products and (2) such products can satisfy a desire for emotional stimulation. Together, these arguments suggest high emotion online reviews are more likely to trigger purchasing than low emotion online reviews.

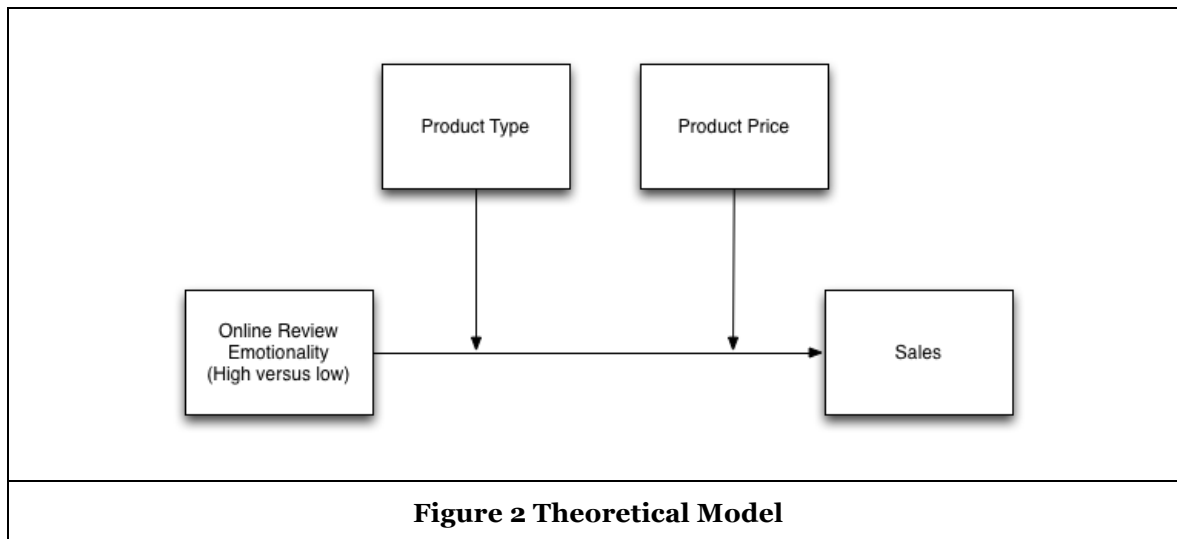
Utilitarian products are evaluated differently. Such evaluation is based on the degree of practicality, which is usually a function of the products' tangible attributes (Drolet et al. 2000). Within this category, consumers will strive to maximize practical criteria, as when they decide to purchase a dishwasher (Stranhilevitz and Meyers 1998). That is, the evaluation for utilitarian products is rational, less emotional. This argument suggests that while shopping for utilitarian products consumers may be unresponsive to high emotion online reviews. In sum, product type may play a moderating role in the relationship between online review emotionality and sales.

Product Price

Product price can be classified into two categories: free and priced (Figure 2). As the Internet dramatically reduces the cost for product storage, especially for E-business, free products/services are ubiquitous online. For example, companies provide free trial services, such as LinkedIn's premium plan and Heroku's free account, to attract new consumers or to increase online traffic to their websites. Free products can serve as giveaways to increase brand awareness and consumer loyalty. Reducing a price to zero will dramatically increase demand, and consumers will even expend extra effort to acquire free products (Shampanier et al. 2007). For instance, when Ben and Jerry's offers free ice cream, many people spend hours in line waiting to get a cone.

High emotion online reviews may arouse consumers and they may also indicate reviewers' strong emotions. The attraction to free products may amplify the positive impact of high emotion online review on sales. By contrast people apply market norms and become economically rational when products are priced (Heyman and Ariely 2004). This suggests, while shopping for priced products, consumers may be unresponsive to high emotion online reviews and may not weight these reviews heavily. Therefore, we conjecture that product price (priced versus free) will moderate the relationship between online review emotionality (high versus low) and sales. In this context, sales will be understood to encompass not only a purchase with money but also the acquisition of a free product: in each case the consumer takes action to take possession of or experience a product. This understanding is consistent with how Amazon defines sales rank: Amazon calculates the best-seller rank using acquisition numbers that include both purchases and free downloads.

To summarize, we propose a theoretical model where online review emotionality (high versus low) affects sales and such impact is moderated by two product characteristics: product type and product price (Figure 2).



Hypotheses

Prior literature suggests high emotion online reviews are more likely to trigger actions including purchasing actions. Specifically, consumers may be aroused by these reviews (Gaertner and Dovidio 1977). Presented with high emotion positive reviews, consumers may be convinced by such positive emotions and may attribute such emotions to the reviewed products (Folkes 1988). On the other hand, protected by online anonymity, consumers may exhibit intense curiosity when presented with high emotion negative online reviews and may also attribute negativity to reviewer personal dispositions instead of the product (Baumeister et al. 2001; Folkes 1988). As a result:

H1. (The emotionality hypothesis) High emotionality in the review is more likely to increase sales than low emotionality in the review

Moreover, the evaluation of hedonic products is subjective and emotional, whereas the evaluation for utilitarian products is comparatively objective and rational (Adaval 2001; Drolet et al. 2000; Hirschman and Holbrook 1982). Then, high emotion online reviews are more likely to affect hedonic products than utilitarian products, leading to the second hypothesis:

H2. (The product type hypothesis) Emotionality in the review affects the sales of hedonic products more than the sales of utilitarian products.

Also, people are excited by free products, but they tend to be economically rational about priced products (e.g., Heyman and Ariely 2004; Shampanier et al. 2007). High emotion online reviews may amplify the excitement for free products and encourage people to make an acquisition, whereas high emotion online review may not affect people's purchasing decision for priced products:

H3. (The product price hypothesis) Emotionality in the review affects the sales of free products more than the sales of priced products.

Method

To test the hypotheses and the theoretical model, we conducted an online experiment on Mechanical Turk¹. We chose an experiment so as to examine the causal relationship between emotional expression in the review and sales in a controlled setting.

Experimental Design

This experiment involves three factors: online review emotionality (high versus low), product type (utilitarian versus hedonic), and product price (priced versus free). Each factor has two levels, making such experiment a 2 by 2 by 2 factorial design (See Table 1: part 1 and part 2).

Product Type	2 utilitarian videos	2 hedonic videos
Sub-conditions	High emotion online review versus low emotion online review (negative or positive)	High emotion online review versus low emotion online review (negative or positive)
# of participants	60	60
Table 1 Experimental Design (Part 1) Free Conditions		

Product Type	2 utilitarian videos	2 hedonic videos
Sub-conditions	High emotion online review versus low emotion online review (negative or positive)	High emotion online review versus low emotion online review (negative or positive)
Price	5 cents	5 cents
# of participants	60	60
Table 1 Experimental Design (Part 2) Priced Conditions		

We conducted the experiment on Mechanical Turk; participants are workers on MTurk. Each worker has received \$0.5 for a completed task.

Online Review Emotionality

To control for the possible influence from the valence of reviews, we used a 1-star rating to represent negative valence and a 5-star rating to represent positive valence. For each sentiment level, we displayed two online reviews with distinct online review emotionality. We used high and low emotion words as measured by Warriner et al. 2013 in terms of arousal. Specifically, “I LOVE this video very much!” is the high emotion positive review (arousal rating = 5.36) and “I think this video is good” (3.66) is the low emotion positive review. Also, “This video made me very ANGRY!”(6.2) is the high emotion negative review and “This video put me to sleep”(3.6) is the low emotion negative review. Participants were assigned to see either the positive reviews (high emotion versus low emotion) with the 5-star ratings or the negative reviews (high emotion versus low emotion) with the 1-star ratings.

Product Type

¹ Mechanical Turk is a crowdsourcing market place. Many researchers in the social sciences use it as a platform to perform experiments.

We used different Creative Commons videos with distinct product types. To control for the influence of product quality, for each product type we used two videos that appeal to a general audience. These four videos are all under a Creative Commons license for reuse, so they are suitable for experiments and publication. Table 2 (part 1 and part 2) shows the four video snapshots and the video titles that were displayed to participants in this experiment.

	Utilitarian video 1	Utilitarian video 2
Title	Planting Mature Plants	Introduction to DSLR Cameras
Snapshot		
Table 2 Videos Used in the Online Experiment (Part 1)		

	Hedonic video 1	Hedonic video 2
Title	Frame of Mind	The Village
Snapshot		
Table 2 Videos Used in the Online Experiment (Part 2)		

Product Price

We manipulated the bonus option on MTurk to provide distinct product prices. In the free scenarios, participants don't need to pay to click a video. By contrast, in the priced scenarios, we first gave each subject a bonus of \$0.2 through the bonus option and then asked "Do you want to spend 5 cents out of the 20 cents to watch one of the videos below?" in the task (HIT). By doing so, we can (1) keep MTurk workers motivated to continue with this HIT and (2) exclude those who only wanted to make money without performing the task. In addition, in order to be consistent with the experimental design in the priced conditions, in the free conditions, we also asked MTurk workers "Do you want to watch one of the videos below?".

Dependent Variable

Sales (or, more generally, acquisition) were measured according to whether or not each video was clicked and watched in each sub-condition.

Procedure and Sampling

We assigned 60 MTurk workers to each sub-condition. Thirty workers only saw the positive online reviews and the other 30 only saw the negative reviews. Specifically, each of the participants was asked to first see two videos and their respective brief description as well as their respective online reviews. One

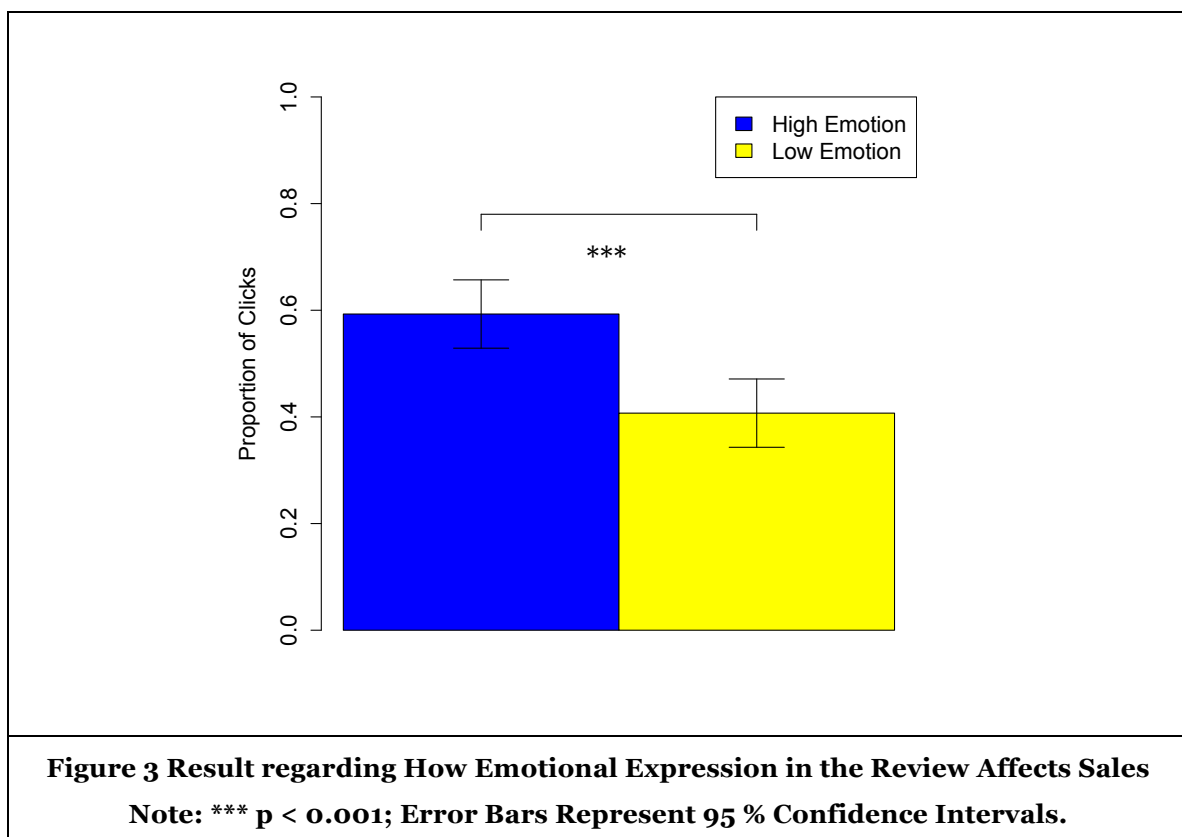
video had a high emotion review; the other video had a low emotion review. To control for the influence of the video content, we randomly matched a video with a review. Then each of the participants was asked to click and watch one video out of the two. Participants then provided their reasons to click/not click (purchase/not purchase) this video and their demographic information (including gender, age and mother tongue). Participants joined exactly one sub-condition.

In total 240 MTurk workers were assigned in the experiment. In the priced conditions, only 12 out of 120 workers chose to keep all the bonus money and not participate, whereas in the free conditions, only 2 out of 120 workers chose not to participate. All the participants were United-States based workers who had approval rates, as tabulated by Amazon, higher than 95%. 45% of those workers were female and 55% were male. They were between 18 and 72 years of age, with a mean of 33.

Results

Because the dependent variable is count data, we used proportion tests (a variation of chi-square tests) for analysis. Figures 3 and 4 show the results.

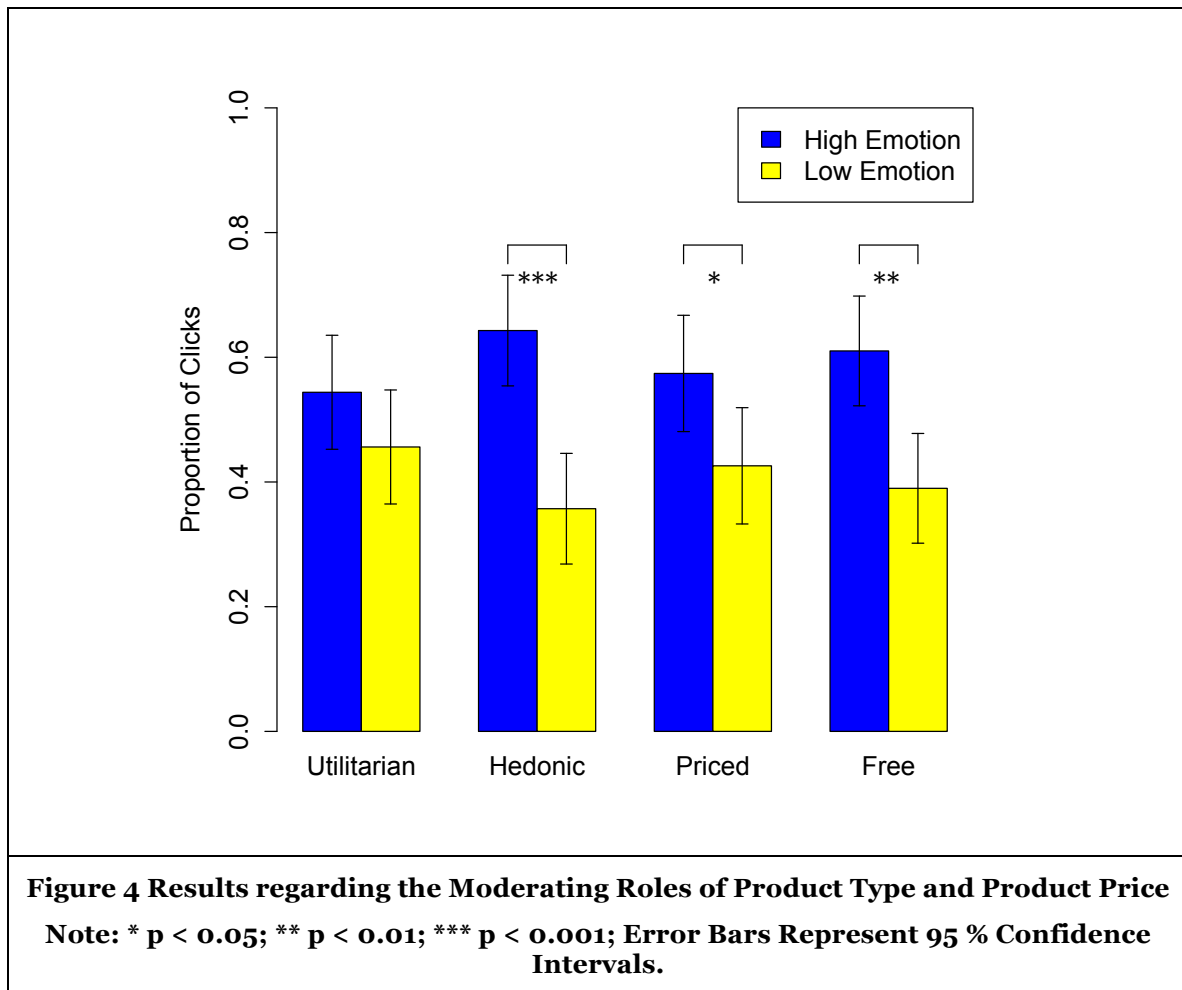
The emotionality hypothesis is supported. We aggregated data regardless of product type and product price and examined how online review emotionality (high versus low) affects sales. Using a proportion test, the finding shows that videos with a high emotion review received more clicks than those with a low emotion review (59% versus 41%; $p < 0.001$). That is, the main effect of emotional expression in the review on sales is supported.



The product type hypothesis is also supported. Using a proportion test, hedonic videos with a high emotion review received significantly more clicks than those with a low emotion review (64% versus 36%; $p < 0.001$). However participants had no preference in choosing utilitarian videos with a high emotion review versus a low emotion review (54% versus 46%; $p > 0.1$). We then conducted a proportion test to examine whether product type affects a video's chance of being selected and watched given a high emotion

review compared to a low emotion review. The result shows the significant impact of product type on participants' selection of videos given a high emotion review versus a low emotion review ($p < 0.001$). In other words, the moderating role of product type is supported.

The product price hypothesis, however, is not supported. Using a proportion test, priced videos with a high emotion review gained significantly more clicks than those with a low emotion review (57% versus 43%; $p < 0.05$). This finding also holds for free videos (61% versus 39%; $p < 0.01$). Another proportion test shows that product price (priced versus free) doesn't affect a video's chance of being selected and watched given a high emotion review versus a low emotion review ($p > 0.1$). That is, the moderating role of product price is not supported.



Thus, the theoretical model is partially supported. Table 3 summarizes the results.

Hypothesis	Support level	Findings
H1. The Emotionality Hypothesis	Supported	High emotion online reviews can increase sales compared to low emotion online reviews
H2. The Product Type Hypothesis	Supported	High emotion online reviews can increase sales for hedonic products, but not for utilitarian products.
H3. The Product Price Hypothesis	Not Supported	High emotion online reviews can increase sales for free products as much as they can for priced products.
Table 3 Summary of Results		

Discussion

Our findings show that emotional expression in online reviews (high versus low) affect sales. Depending on product type and product price, high emotion online review can either significantly increase sales, or have no impact on sales. These findings hold true for both positive and negative online reviews.

The finding regarding negative online review sentiment will be surprising to many. High emotion negative online reviews such as “This video made me very ANGRY!” can increase sales for hedonic products. We can think of one plausible reason: These reviews may amplify people’s curiosity. People are curious by nature (Berlyne 1954). Since negative information is attention grabbing, high emotion online reviews can provoke individuals’ curiosity and trigger individuals’ desire for entertainment. When negative online reviews describe intensive emotions including anger, contempt, disgust, guilt, fear, and nervousness, such curiosity and desire may be amplified. In fact, previous media research has indicated that the prevalent negative tone of television news stories is driven by people’s morbid curiosity: a mixture of compulsion, excitement, and fear; this is further supported by the popularity of fictional shows focused on macabre topics (Pinkerton and Zhou 2008; Zuckerman 1984).

Implications for Systems Design

A designer of an online review system may have several objectives. For example, the designer may aim to increase overall sales, while at the same time reducing product returns as a result of mismatches between customer expectations and product performance. Current systems appear to focus on the valence of the review, providing a sampling from the highest and lowest starred reviews. Some systems also let viewers rate the usefulness of the reviews. But to our knowledge, the systems do not use the emotional level of the review in deciding which reviews to display. Our study suggests that, in some cases, presenting high emotion reviews will result in an increase in purchasing behavior. That is, the system could prioritize these high emotion reviews. This might accomplish the system goal of driving sales. But it is possible there might be undesirable side effects: purchase decisions made as a result of such emotion-laden reviews may be unsatisfactory, leading to increased returns or, in the case of free products, increased regret. Indeed, effects related to emotion may already be happening, if, for example, it turns out that reviews presented tend to skew one way or another with respect to the degree of emotion. More subtle algorithms may seek to equalize, or fairly represent, the emotional level of both positive and negative reviews. Our results suggest that the effects of such manipulation will be strongest with hedonic products, and weak or absent with utilitarian products.

Future research might look into the information value of emotion in reviews. While emotion may sometimes be used as a rhetorical device, aggregated results might reflect the degree of commitment customers have to proselytize prospective purchasers about particular products. In other words, some products provoke passion, and systems designers may want to highlight the passionate reviews if experiments show such reviews improve consumer decision-making.

Concluding Thoughts

Emotional expression in online reviews affects sales. This paper finds that such impact on sales is moderated by product type, but not by product price. These findings hold true for both positive and negative online reviews.

These findings are related to prior research on how emotion shapes trends (Berger and Milkman 2011). That research found that high emotion positive or negative content is more viral. Our paper focuses on online reviews and shows that people are more likely to make a purchase when presented with online review text that is highly emotional. Such a tendency varies for products with different characteristics. For hedonic products, describing something in an exciting way, even if the evaluation is negative, might encourage purchasing behaviors; for utilitarian products, describing something in a boring way might do no harm to sales. For the information systems designer, these results may be valuable in designing the algorithms that decide which reviews to present to consumers.

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